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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Some Sprouting Characteristics of Five-Stamen Tamarisk

Howard L. Gary and Jerome S. Horton ¹

Five-stamen tamarisk or saltcedar (Tamarix pentandra Pall.) now occupies many thousands of acres of flood plain and delta deposits in the Southwest. Water-user organizations and other agencies concerned with water resources believe that tamarisk consumes large quantities of water and that considerable water can be saved by controlling it.²

Control of tamarisk by use of mechanical equipment, various chemicals, and lowered water table have been tried with some degree of success. Poor results with some mechanical methods can often be traced to the vigorous sprouting ability of tamarisk stems. Knowledge of the physical sprouting characteristics of tamarisk can make it possible to design and time mechanical control programs for greater success.

Studies of the sprouting characteristics of tamarisk stems and roots were conducted under laboratory conditions during the period from March 1958 to December 1960. In pre-

liminary studies in 1958, no difference was detected in sprout development from stem cuttings taken from various heights and locations within tamarisk shrubs. In a companion study, root cuttings taken at various distances away from the root crown failed to form new plants. No further studies with root cuttings were undertaken. Additional studies were undertaken to obtain information on relations of sprouting characteristics of stem sections to seasons and temperatures, moisture contents, and varying degrees of drying.

Season of Sprouting and Temperature Effects

The relation of sprouting ability to season was determined by planting stem sections at biweekly intervals from July 1959 through April 1960 in a heated and well-ventilated greenhouse. The cuttings were taken at random from several plants on a shallow-water table (0-2 feet) site near Granite Reef Diversion Dam on the Salt River, east of Phoenix, Arizona. Twenty cuttings, 0.5 to 1.0 inch in diameter and 6 inches in length, were planted singly in clay pots containing fine-textured alluvium soil. The potted cuttings were in normal vertical position with about 2 inches of the stem exposed above the soil surface. The soil medium was kept continuously moist. Similar planting procedures were followed for other portions of the study. All cuttings even-

¹Associate Range Scientist and Principal Plant Ecologist, located at Tempe, in cooperation with Arizona State University; central headquarters are maintained at Fort Collins, in cooperation with Colorado State University.

²Horton, J.S. The problem of phreatophytes. Symposium of Hannoversch-Munden, Internatl. Sci. Hydrol. Assoc. Pub. 48, 1: 76-83. 1959.

tually produced sprouts. Length of time for 100 percent sprouting was greatly increased, however, during the cooler months (table 1).

To check temperature effects on sprouting rates, a duplicate set of 20 cuttings was placed in an unheated greenhouse on November 18, 1959. As shown below, sprouts appeared on cuttings planted in the heated greenhouse much sooner than in the cold greenhouse, but in the latter all cuttings eventually did produce sprouts in the warmth of spring:

Location and number of weeks after planting	Sprouting rates (Percent)	Average temperature (Degrees F.)
Heated greenhouse:		
4	20	75.0
8	80	70.8
12	85	76.0
16	100	79.5
Unheated greenhouse:		
4	10	54.7
8	10	47.6
12	40	50.8
16	80	55.3
20	100	67.4

Thus, ability to sprout is present in the stem tissue during the winter if temperatures are high enough to induce it.

Stem Moisture Content and Sprouting

The seasonal study was reoriented in 1960 to include cuttings taken from two diverse sites and to include a measurement of stem moisture content. All cuttings were collected along the Salt River--one-half were cut at the shallow water-table site near Granite Reef Diversion Dam, and the other half near Tempe with a water table deeper than 15 feet. From April to December 1960, 20 cuttings were collected at monthly intervals from each site, planted in a heated and ventilated greenhouse, and observed daily until the sprouts reached 0.4 inch in length.

One-year-old canes 0.5 to 1.0 inch in diameter and 2 feet long were cut from random portions of tamarisk plants. The canes collected in the field were placed in a water-tight plastic bag. A wet burlap sack was then wrapped around the plastic bag to prevent excessive loss of moisture from the tamarisk canes. After immediate transport to the laboratory, each cane was cut into two 8-inch sections. One-inch sections were then cut from each end of the 8-inch sections and identified with the remaining 6-inch sections. The 1-inch sections were weighed immediately on a direct-reading balance, oven-dried, reweighed, and percent moisture determined from oven-dry weight:

Table 1. --Relation of sprouting of tamarisk to season in a heated and well-ventilated greenhouse, July 1959 to April 1960

Month	Number of cuttings	Number of weeks after planting					
		4	8	12	16	20	24
- - - <u>Percent of cuttings with sprouts</u> - - -							
July	20	100					
August	40	75	100				
September	40	90	100				
October	40	75	95	100			
November	40	38	85	90	98	98	100
December	40	15	70	90	95	100	
January	40	58	100				
February	40	85	100				
March	40	95	100				
April	20	100					

$$M = \frac{G - D}{D} \times 100$$

where

M = percent moisture

G = green weight

D = dry weight

The percent moisture content of the 1-inch sections was used to approximate the moisture content of the planted 6-inch sections.

Sprout development was most rapid during the warmer months of the year and slowest in the colder months (fig. 1). Variance analysis did not show significant differences in rapidity of sprout development for cuttings collected from shallow and deep water-table sites.

The period of lowest moisture content of the cuttings was in March when tamarisk usually begins new growth (fig. 2). Moisture content was highest during the warmer months. The cuttings from the shallow water-table area show an increase in moisture content until June, and a downward trend for the remainder of the year. The cuttings from the deep water-table area usually had a higher average moisture content, but show the same general pattern of increasing moisture content during their active growing season. Monthly

changes in stem moisture during the growing season, however, were more erratic for cuttings from the deep water-table area.

Stem Moisture Loss and Sprouting Ability

The effect of stem moisture loss on sprouting ability was followed from April through December 1960. Eighty tamarisk cuttings were taken monthly from plants growing on the shallow water-table site. The cuttings were weighed and dried for varying periods of time in the laboratory before planting in a heated and ventilated greenhouse. The study procedure was as follows:

1. Percent moisture content of 1-inch sections taken from each end of an 8-inch section was determined by the method discussed in the previous section.
2. After initial weighing of the remaining 6-inch sections, they were placed in horizontal position in a shallow tray and allowed to dry at room temperature (75° to 80° F). The room temperatures did not vary appreciably between summer and winter.
3. Random groups of 10 cuttings were then reweighed and planted after 8 drying periods that ranged from 15 to 116 hours.

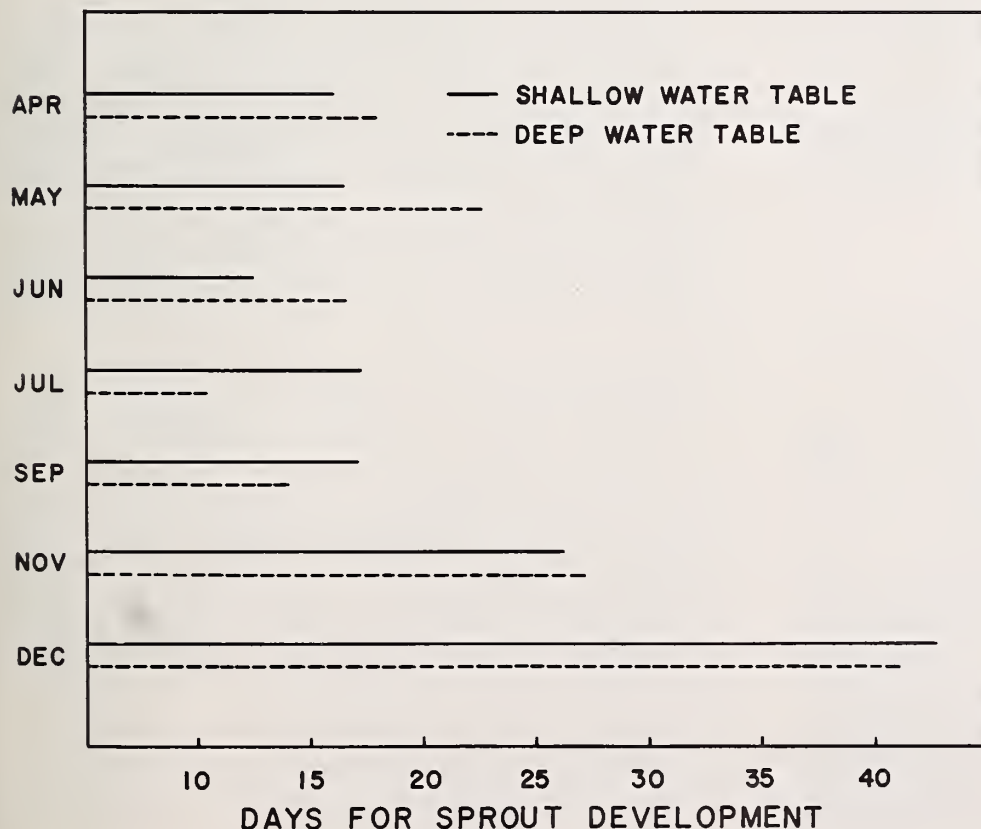


Figure 1.--Number of days for sprouts to reach 0.4 inch in length. Sprouting was 100 percent for all months. Twenty cuttings from each site were used in monthly tests.

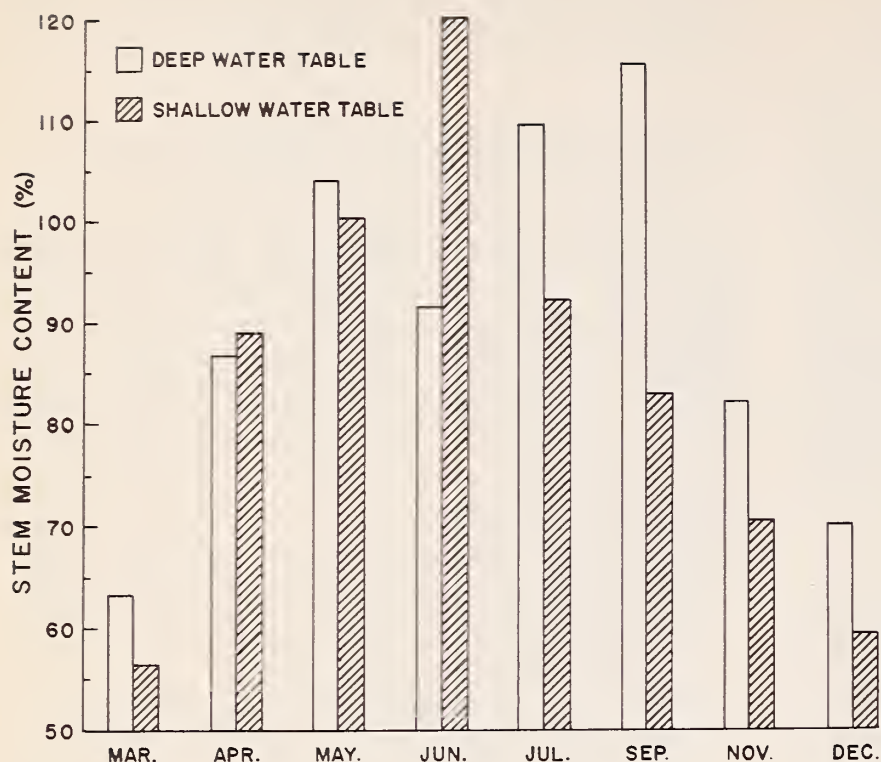


Figure 2.--Average stem moisture content (calculated from dry weights) for cuttings taken from tamarisk plants on shallow and deep water-table sites.

4. Percent water loss from cuttings dried for varying periods was approximated by the formulas shown below:

a. $CWS = \frac{IWC}{1 + M}$

where

CWS = calculated ovendry weight, 6-inch sections

IWC = initial weight, 6-inch cuttings

M = moisture percent, ovendry basis, of the two 1-inch end sections

b. $ML = \frac{WL}{CW} \times 100$

where

ML = percent moisture loss at planting

WL = water loss before planting

CW = calculated ovendry weight

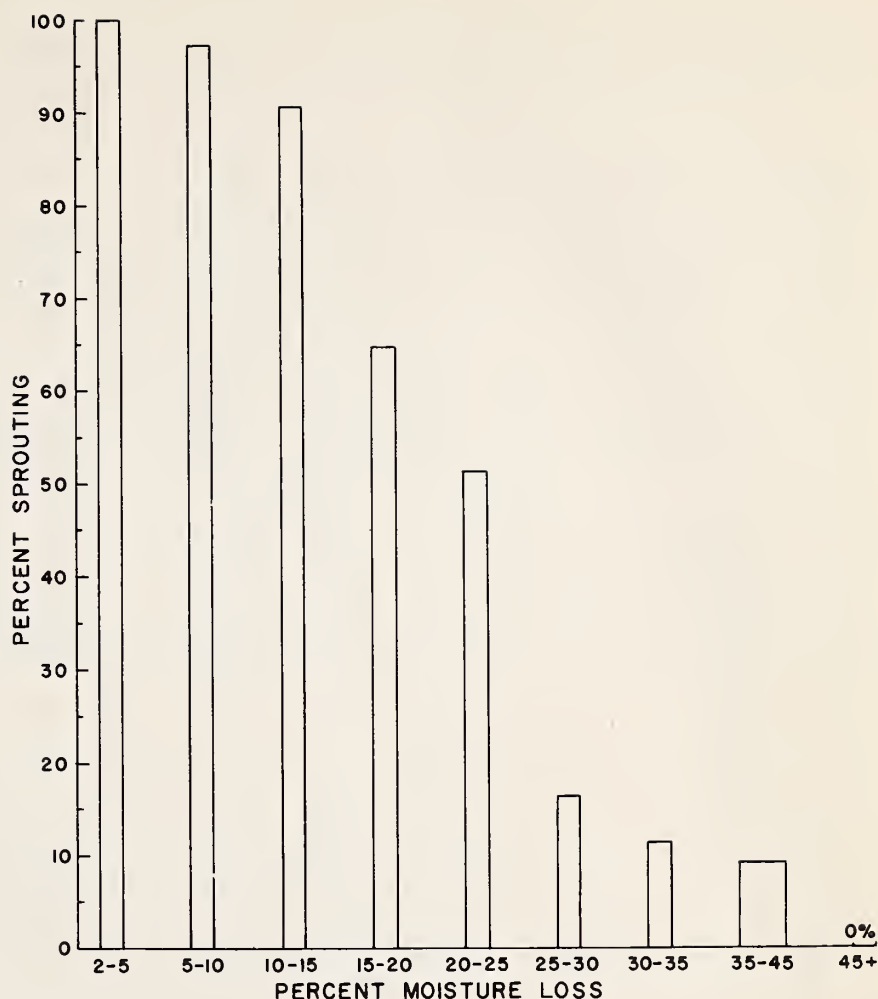
5. Individual cuttings were observed until sprout growth reached 0.4 inch or for 4 months if no sprouting occurred.

A definite relationship of moisture loss (expressed as percent of ovendry weight) and sprouting ability was evident (fig. 3). Eighteen or more cuttings were represented in each moisture-loss class presented. A moisture loss of 2 to 5 percent did not affect the sprouting ability of the cuttings. Sprouting

ability was only slightly affected up to 10 percent moisture loss, but dropped rapidly in each succeeding moisture-loss class. No sprouting ability was retained by any cutting after 45 percent moisture loss.

To better interpret the relation of drying to sprouting ability in regard to season, the June and November results were more closely analyzed (fig. 4). The green tamarisk cuttings collected in June dried rapidly and failed to sprout after they lost about 20 percent of their stem moisture (expressed in terms of ovendry weight). The hardened and less succulent stem cuttings collected in November dried at a much slower rate and, therefore, retained sprouting ability longer, but these cuttings lost their ability to sprout at about the same percentage of stem-moisture loss as the June cuttings. The more rapid drying rate of the June cuttings caused a more rapid loss of sprouting ability. Sprouting ability was 80 percent at 15 hours and dropped to 0 percent after 4 days of drying. The November cuttings retained 100 percent sprouting ability for 2 days, and sprouting ability was 50 percent after 4.5 days of drying. This rapid loss of sprouting ability in June when compared to

Figure 3.--Relationship between sprouting ability and percent moisture loss from tamarisk stem cuttings before planting, from a composite of seven tests (560 cuttings) conducted April to December.



the slower drying experienced in November is of significance in control of tamarisk. Clearing of tamarisk by mechanical means, such as bulldozing or root plowing³ has often been unsuccessful because of vigorous sprouting of shoot material buried in the operation. Due both to slow drying of dormant tamarisk canes and to cold soil and weather conditions during the dormant season, chances of a successful clearing operation during winter are much reduced.

The effect of summer drying on sprouting ability was tested during a day in August. Ninety 6-inch stem cuttings were taken at random from several tamarisk plants and dried in the sun for 8 hours on a bare soil surface. The soil surface temperature averaged more than 120° F. during the drying period. At the end of the 8-hour period, the

cuttings were planted in moist, alluvial soil and observed over a 3-month period. No sprouts or roots appeared on any of the cuttings. Thus, a few days of drying during the summer months in the Southwest may be sufficient to destroy most of the sprouting ability of tamarisk shrubs cut by mechanical equipment.

Discussion and Conclusions

Tamarisk stem tissue will sprout vigorously and form new plants if buried or partially buried in warm moist soil. In the active growing season, nearly all undried stem cuttings of all sizes and from any location in the crown of the original shrub produced roots and formed new plants under greenhouse conditions.

Sprouting was delayed during the winter period. In some instances, cuttings planted during the late fall and winter months did not sprout for 3 or 4 months. Undried tamarisk

³Horton, J. S. Use of a root plow in clearing tamarisk stands. U. S. Forest Serv., Rocky Mountain Forest and Range Expt. Sta., Res. Note 50, 6 pp., illus. 1960.

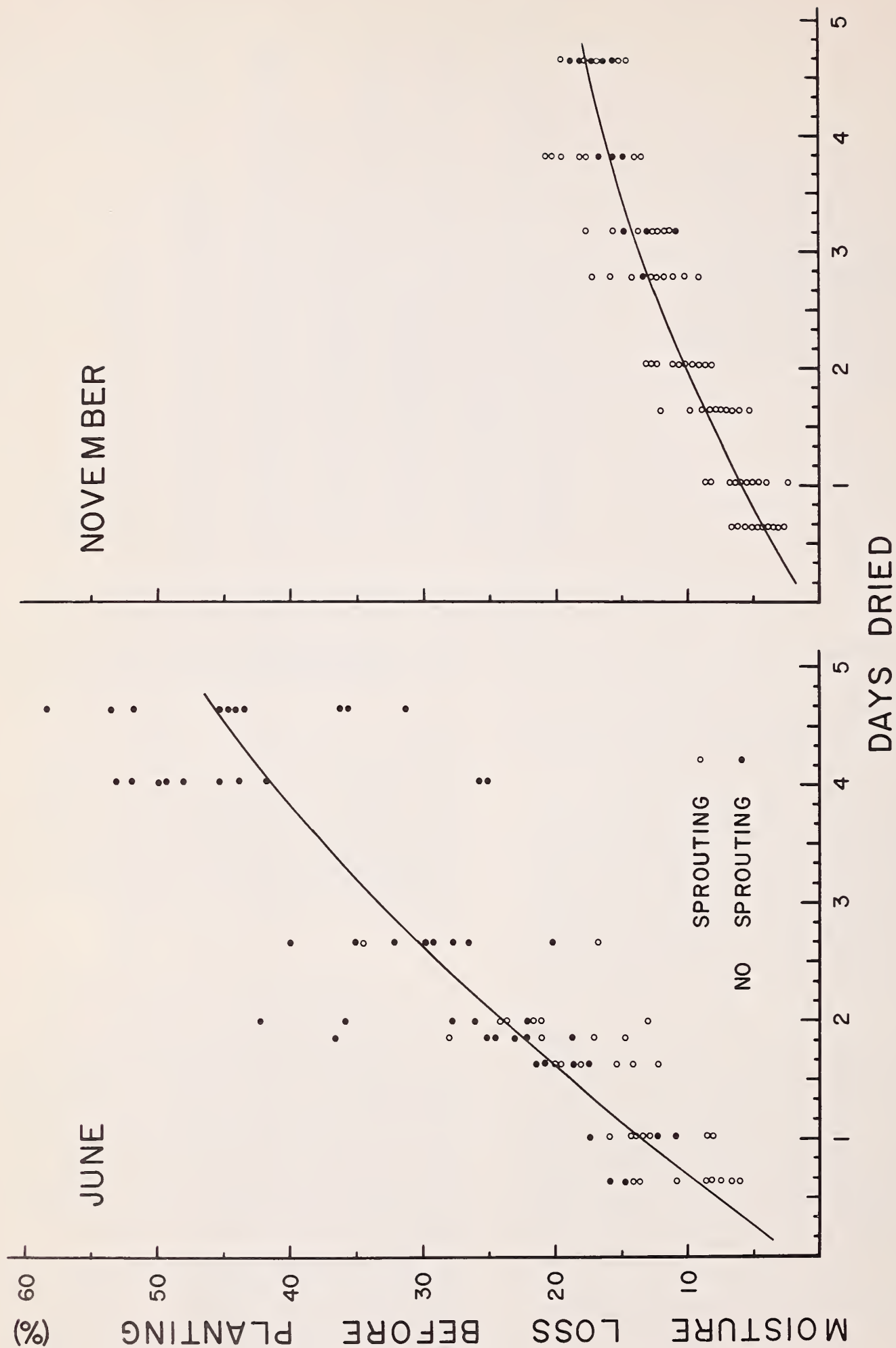


Figure 4.--Regression of percent moisture loss on number of days cuttings were dried before they were planted. Moisture loss was significantly higher in June. Symbols designate sprouting or failure to sprout of individual cuttings.

stems buried in moist soil retained sprouting ability for long periods of time. One cutting planted in November sprouted after 6 months of dormancy.

Stem cuttings followed a pattern of high moisture content and rapid sprouting in the early summer, and low moisture content and reduced sprouting activity in late fall and winter.

The drying of cuttings reduced sprouting ability. A stem moisture loss of 5 to 10 percent of oven-dry weight had little effect on sprouting, but after 15 percent moisture loss, sprouting success dropped rapidly. No sprouting occurred after 45 percent moisture loss. Cuttings made in summer were more succu-

lent than cuttings made in the fall or winter, and lost moisture more rapidly. Summer cuttings also lost sprouting ability more rapidly.

The moisture level at which sprouting of tamarisk stem tissue ceases is quite variable and the rate of drying cannot be regulated for use in practical control measures. However, this study indicates that land managers can take advantage of the fact that any drying of stem tissue will reduce sprouting ability. Some management recommendations to prevent reestablishment of tamarisk by sprouting of severed stem portions are: (1) control operations should be done during the growing period when the soil is dry and weather warm; and (2) stems should be left on the surface of the ground and never be buried in moist soil.

